Couch's 'Cornish Fauna' but the *Fredericella Sultana*, which has been found near Penzance. There can be little doubt, however, that many of the species might be discovered by careful examination.

EXPLANATION OF PLATE XVI.

Fig. 1. *Mimosella gracilis*, Hincks, nat. size.
Fig. 2. *Arachnidia hippothooides*, n. sp., magnified : 2*a*, a single cell, more highly magnified.
Fig. 3. *Discoporella flosculus*, n. sp., nat. size and magnified : 3*a*, side view of cells; 3*b*, one of the tubular orifices in the centre of the disk.

LII.—*On the supposed Bilateral Symmetry of the* Ctenophora. By Fritz Müller*.

In radiate animals we can distinguish *only* the front from the back, *or* the top from the bottom; in bilateral animals we can *simultaneously* distinguish the front from the back, *and* the top from the bottom. Radiate animals are divisible into symmetrical parts through as many planes as there are rays present; bilateral ones only into symmetrical halves through a single plane: radiate animals have an axis at the intersection of the above planes; bilateral ones only the median plane, and no axis. In radiate animals only the parts situated in the axis can be present singly; all the parts in the middle and on the borders of the rays are repeated to the number of the rays, all the other parts to twice this number. In bilateral animals all parts situated in the median plane may occur singly, and all parts out of this plane exist in pairs.

If the divisional planes of the rays be allowed to turn round the axis, retaining their relative position, the animal will constantly be cut into congruent parts; bilateral animals are not divisible into congruent parts. Each individual ray of a radiate animal is bilaterally symmetrical; bilateral animals are not divisible by planes parallel to their longitudinal direction into fragments which are again bilaterally symmetrical.

When the rays are in pairs, therefore, in 2-, 4-, or 6-rayed animals, every plane passing through the axis cuts the body into congruent halves, and each of these sections is again cut through the axis into congruent halves. Bilateral animals (as also Radiata with an uneven number of rays) are not divisible into congruent halves; a right half cannot be replaced by a left one, nor can an entire animal be made out of two right halves of congruent animals. If, on the other hand, two even-rayed animals were cut in the same way into congruent halves, any two

* Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1861.

of these four halves might at pleasure be united to form a complete animal.

Every plane carried through the middle of a ray, as also every divisional plane between two rays, divides even-rayed animals into bilaterally arranged halves. The halves of a bilateral animal, considered separately, are no longer bilaterally arranged.

The series of these characters which separate sharply and abruptly the radiate from the bilateral arrangement of the animal body might readily be carried much further. I break it off here; for already I hear the question, What is the use of this idle enumeration of self-evident differences between things which no one can confound together? Is it not sufficient to have seen a starfish by the side of a crab, or even merely to hear the denominations radiate and bilateral, to prevent our ever doubting which of the two modes of arrangement we have before us? This may be supposed, but evidence to the contrary is furnished, amongst other things, by the Ctenophora. According to all the characters adduced, and however the idea may be otherwise analyzed mathematically, they appear to be radiate and, indeed, *biradiate* animals, and exhibit this structure stamped in the most perfect regularity and most rigidly followed throughout, without the slightest trace of a transition to bilateral arrangement; and yet the prevailing opinion of the day appears to be in opposition to this. Burmeister expresses himself with cautious doubt:—"The Ctenophora appear to be constructed upon both types, yet a regular oval form predominates*." Others regard them positively as "bilaterally symmetrical animals," or as a transition-form "from the radiate type to the bilaterally symmetrical." These are the views of Agassiz†, Vogt, and Gegenbaur. The weighty suffrages of such opponents urged me to a somewhat detailed exposition of the subject, in itself certainly extremely simple. With this exposition of the differences between radiate and bilateral animals my evidence in favour of the position of the Ctenophora among the former is already given. It remains for me to discuss the reasons for the opposite opinion, which, unfortunately, I cannot find brought into connexion in any work accessible to me.

The first inducement to regard the Ctenophora as bilateral animals, or as intermediate between these and radiate animals, has probably been furnished by "the laterally compressed" form of the body of many species, and especially the greatly elongated ribbon-like form of *Cestum*, in which Vogt finds the "symmetrical type" most distinctly displayed, and Gegenbaur considers that "the bilateral symmetry attains its culminating

* Geschichte der Schöpfung, 6. Aufl. p. 330.

† According to the 'Jahresberichte' of V. Carus and Leuckart.

point." If this remarkable form of the *Cestum Veneris* might furnish the inducement to a new investigation of its right to stand as a radiate animal, it cannot, however, be made available as evidence to the contrary, any more than the globular form of a rolled-up *Sphæroma* can exclude that animal from the bilateral series. If the Ctenophora be regarded as biradiate animals, this ribbon-like form, moreover, loses all its remarkableness; *Cestum* then places itself in the neighbourhood of the *Cydippæ* with a circular transverse section, in exactly the same way as the long-rayed *Asteriadæ* and *Ophiuræ* take their place in the neighbourhood of the globular *Echinus*.

A second reason for the assumption of a "bilateral symmetry" appears to have been furnished by the duality of various parts, such as the orifices of the funnel, the oral lobes, the gastric vessels, tentacular filaments, &c. "Even in the otherwise radiately constructed Beroës" Gegenbaur finds "the bilateral symmetry indicated" in the two orifices of the funnel*, and supposes the two tentacular filaments of *Cydippe* to be arranged "in accordance with bilateral symmetry†." It is true that most of the parts of bilateral animals are present in duality; but the distribution of these duplicate parts, in the Ctenophora, upon two planes perpendicular to each other, far from being a proof of bilateral symmetry, is rather something perfectly irreconcileable therewith, and, combined with the quadruplication of all parts exterior to these planes, is a certain characteristic of *biradiate* arrangement. However, quite independent of the characters of radiate and bilateral animals stated above, it is a matter of wonder that the contradiction which lies in regarding the orifices of the funnel and the tentacular filaments as both bilaterally symmetrical has escaped notice. If it be the orifices of the funnel, then, in *Mnemia*, for example, the narrow sides and oral lobes lie right and left, the broad sides with tentacular filaments‡ and gastric vessels above and below. If it be the tentacular filaments, the broad sides and gastric vessels are right and left, the narrow sides, oral lobes, and orifices of the funnel above and below. One supposition reduces the other *ad absurdum*. In both suppositions, moreover, in contradiction to the most essential characteristic of bilateral structure, there is no distinction of dorsal and ventral surfaces.

A further remark of Gegenbaur's has always been unintelligible to me. In the Ctenophora the radiate type of the Cœlenterata is said to pass over into the bilaterally-symmetrical type "by a preponderating development of the individual parts taking

* Wiegmann's Archiv, xxii. p. 170. † *Loc. cit.* p. 176.

‡ These are indeed very minute, but not wanting, in *Mnemia Schweigeri*, Eschsch.

place on two symmetrical halves of the body*." As the animal has only two halves, and consequently the two halves with preponderating development of parts constitute the entire animal, one does not understand where the parts remaining backward in their development can find a place. But if we were to understand by the term "halves" only opposite parts of the body (and one is accustomed to find a perfectly new mathematical language in works on natural history), the relation occurring in the Ctenophora, and indicated as in favour of "bilaterally symmetrical type," would not be any better expressed. Or are the orifices of the funnel and the oral lobes preponderatingly developed gastric vessels and tentacular filaments, or *vice versâ*? Or are our own arms and legs preponderant developments of some parts of our dorsal and ventral surfaces?

In his 'Zoologische Briefe' †, Carl Vogt has explained, in his usual simple and luminous manner, the distinctions between radiate and bilateral structure. According to this representation of his own, he ought to have indicated the Ctenophora unconditionally as perfectly radiate in their structure. And yet even he has allowed himself to be led astray by the "long transverse ribbon" of the *Cestum Veneris*, which, as he remarks in his 'Ocean und Mittelmeer,' "may be divided, by a cut carried transversely upon the axis of the band, into two perfectly similar halves, in which not the least trace of a radiate arrangement can be detected:" it is sufficient to add, "any more than in an individual ray of any other radiate animal," in order to show that the indisputable fact proves nothing adverse to the radiate construction of animal. And if we further indicate that the halves are indeed *perfectly similar*, that is to say, not merely symmetrical, but congruent, and that each of them displays a bilateral arrangement, a peculiarity is pointed out which certainly occurs in all biradiate animals, but not in a single bilateral one.

But are not the Ctenophora, although perfectly radiate animals, still, as being *biradiate*, more nearly allied to the *bilateral* animals than other polyradiate forms, and consequently to be regarded as intermediate? I think not. The apparent similarity, existing only in name, disappears as soon as we exchange "bilateral" for "non-radiate." On the contrary, the smaller the number in which an animal or vegetable organ exists, the more certainly is it usually retained. And so in this case it might be expected that the smaller the number of rays, the more rigidly will the radiate structure be carried out, and that a transition into other modes of arrangement will occur rather with a high than with a low number of rays. Experience confirms this conjecture: leaving

* Grundzüge der vergl. Anatomie, p. 67.
† Bd. i. pp. 64 & 65.

out of consideration the Echinodermata, in which Johannes Müller's acuteness everywhere recognized traces of bilateral arrangement, such are to be found amongst the Cœlenterata, for example, in the 12-rayed *Philomedusa Vogtii*, and in the young brood of the equally many-rayed *Cunina Köllikeri*. The radiate structure is exhibited, on the contrary, with the greatest strictness in many four-rayed Discophora, and in the biradiate Ctenophora, which therefore prove, even in this respect, to be true Cœlenterata.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 14, 1862.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

Description of Sphyrocephalus labrosus*, a New Bat from Old Calabar River, Western Africa. By Andrew Murray, Ass. Sec. R. Horticultural Society.

Pteropini.

Sphyrocephalus, nov. gen.

Dental formulary:—

Incisors.	Canines.	Molars.	
		Premolars?	True molars?
$\frac{4}{4}$	$\frac{1}{1}$	$\frac{1}{2}$	$\frac{2}{3}$

Head very large and oblong; the lips largely developed and expanded. Ears rather large, without tragus. Thumb and index-finger of hand unguiculate, the other fingers without claws. Tail wanting.

Sphyrocephalus labrosus, sp. nov.

Brown, with a few whitish hairs at the base of the ears. The head very large, massive, half as long as the whole body, oblong, and as broad at the muzzle as at the top of the head, with some resemblance to a hammer, whence the name hammer-headed (*Sphyrocephalus*), rather more than twice as long as deep; ears rather large, destitute of tragus; eyes rather large; eyelids provided with eyelashes; nostrils large and tubular; lips extraordinarily developed;

* Since this paper was in print, the last number of the 'Proceedings of the Academy of Natural Sciences of Philadelphia' has been received in this country (the first copies arrived on 19th February, 1862); and in it I find a description of a new Bat, which probably belongs to this species, by Dr. Harrison Allen (Proc. Acad. Nat. Sc. Phil. July 1861, p. 156). It is said to be taken from a specimen collected by M. Du Chaillu, and is named by Dr. Allen *Hypsignathus monstrosus*. If it is the same species, of course Dr. Allen's name must take precedence. His description does not quite correspond with mine, but, judging from the description of the nose, may, perhaps, have been taken from a dried skin, whereas mine is from a fine example in spirits. M. Du Chaillu has exhibited no specimen of this Bat in England.